Teach as you preach: Professionalizing teaching assistants in science and engineering within the 2020 context

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INTRODUCTION

At KU Leuven, practice sessions are traditionally the responsibility of teaching assistants (TAs), typically PhD students with an additional teaching assignment [1, 2]. The Faculty of Engineering Science attaches great importance to the role of the TAs since practice sessions are an indispensable tool in a student's learning process [3]. After all, these additional contact moments serve as the necessary bridge between the theory taught during the lectures and the practice these students will face during their exams and in their future careers. Since many TAs struggled with coaching these practice sessions [4], the Faculty of Engineering Science at the KU Leuven introduced an educational training programme for PhD students in 2005.

As a consequence of educational developments in the course of the past ten years the existing TA training needed to be evaluated and updated, so the PRIMA (Professionalization in Engineering Science: the Millennium Assistant) project was brought to life. The aim of this project is to revise the current training program and to adapt it to the present needs and expectations of the TAs at the Faculty of Engineering Science. In order to identify the priority needs of TAs with an educational assignment and to evaluate the existing training program, a large scale questionnaire was organized in 2013 among the TAs at the Faculties of Engineering Science, Science, Bioscience Engineering and Engineering Technology, combined with focus groups with seventeen TAs of five deliberately chosen courses at the Faculty of Engineering Science.

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In what follows, the results of the survey and hearings will shortly be discussed since they were one of the major sources of inspiration for the new TA training. Furthermore, based on these results, some priority needs were identified and we suggest possible ways to remediate, drawing on the 'teach as you preach' principle [5]. This guiding principle was used to develop a blueprint for the new TA training that will respond to the identified issues, enabling the TAs to get acquainted with new didactical techniques that will enhance and facilitate the learning process of their students. This program will consist of a number of sessions that revolve around different teaching formats, designed to reflect the educational practice of the TAs. These training sessions will focus on the principles of flipped teaching, dealing with frequently occurring problems, activating students and the implementation of modern technology in the teaching practice. Finally, we will discuss the substantive, formal and structural improvements that the new TA training will entail, as well as the accompanying materials and the plans for the future.

1 TEACH AS YOU PREACH

1.1 'Teach as you preach' principle

According to the 'teach as you preach' principle, teachers should apply the same teaching methods to their student teachers as those that are considered desirable to be put into practice by these students in their further educational careers [5]. This principle sterns from a constructivist approach of teaching [6] in which student-activating teaching methods are the central approach and should therefore be taught during teacher education. In 2004, Gibbs and Coffey [7] discovered that training university teachers increased the likelihood of them adopting a student-focused approach to teaching, which is known to stimulate students to take a deep approach that *makes sense* of content, rather than a surface approach which causes students to merely *remember* the content [8]. Research demonstrates that student teachers who experienced student-activating teaching methods themselves during their education showed an increased student-focused teaching approach afterwards, thus confirming the hypothesis that students who experience such methods are more willing to utilise them in their own teaching practice, consistent with the 'teach as you preach' principle [5].

1.2 Translating the principle to the TA training

Central to the 'teach as you preach' principle and the constructivist approach are student-activating teaching methods such as problem-based assignments, case-related tasks and collaborative paper assignments [5] which can be included in our currently existing training program. At the moment, some student-centred elements are already part of the training, such as group discussions and a debate on how to deal with several case studies. The main format of the training, however, is still lecture-based, which should make out a smaller part of the new training sessions. This way, the TAs attending the sessions get in contact with different, more student-oriented, teaching methods which will most likely inspire them to reflect on their own teaching practice. As the result of an experiment, however, Struyven and colleagues [9] determined that, while many students appreciate activating methods in their education, some others aren't as enthusiastic about them and preferred a lecture-based education. This may be partially due to an unsuccessful adaptation to new learning methods, which can be solved by gradually implementing student-activating teaching methods in combination with lectures.

Since the questionnaire and focus groups revealed that the TAs experience a lack of information on the use of modern technology in the classroom, this will be more thoroughly discussed in the new TA training as well. Shieh [10] demonstrated that the implementation of Technology-Enabled Active Learning (TEAL) in class leads students to be more interested in attending and more actively participating. On top of that, the TEAL class made significant progress in conceptual understanding and math manipulation skills. This leads us to believe that modern technological devices are vital tools in student-activating teaching methods, for example in the form of an Interactive Response System that enables the instructor to create polls during class to heighten attention and interactivity.

2 GUIDING PRINCIPLES RESULTING FROM THE SURVEY AND HEARINGS

2.1 Survey and hearings

A questionnaire was designed using Monkey Survey and distributed through the various department chairpersons at the Faculties of Engineering Science, Science, Bioscience Engineering and Engineering Technology at the KU Leuven. This survey consisted of five parts in which questions about five specific themes were included [11], namely the identification of the respondents, an evaluation of the current TA training, experiences with their current teaching assignment, the motivation and workload and their expectations and wishes for the future TA training.

The target population consisted of all the TAs who are assigned with a teaching assignment at the aforementioned four faculties at the KU Leuven. Although the TAs at the Faculties of Science, Bioscience Engineering and Engineering Technology were included in the survey, the focus of the PRIMA project is on the TAs at the Faculty of Engineering Science. Since the TAs at these other three faculties fulfil similar assignments, however, their opinions were valuable as well to get better insight in the most common pitfalls and needs concerning the currently existing TA training program.

The results of the questionnaire were further clarified through hearings with respectively seven, six and four TAs employed at different departments of the Faculty of Engineering Science. Among them were TAs teaching large and smaller groups of students as well as bachelor and master's students and while most of them were Dutch speaking, some foreign respondents were included to ensure a diverse range of opinions. These interviews lasted approximately two hours, during which an educational developer took note while another led the conversation to direct the group discussion and to keep it going. Both the survey and the hearings provided us with insight in the qualities of the current TA training program and the unfulfilled needs of the TAs that were used to formulate our guiding principles and will constitute the basis for the future training.

2.2 Guiding principles derived from existing needs

Through the questionnaire and focus groups with TAs, we learned more about the aspects of the current TA training that are appreciated (such as the 'class' format, practical tips 'n tricks, evaluation sheets, peer learning through group discussions), as well as the working points that need to be changed towards the future. These problem areas can be subdivided in three categories, namely substantive, formal and structural issues.

Substantive principles

The new TA training should only provide the participating TAs with content that actually applies to their everyday practice, which wasn't always the case in the existing training program, as demonstrated by the results of the survey and the hearings. To ensure this, the new educational training program for TAs will be built on the 'teach as you preach' principle by departing from the working method of the TAs, enabling the coaching sessions to closely match their teaching practice [11]. Since the results revealed a lack of attention to modern technological devices during the sessions, more attention will be paid to those devices used by the TAs in their teaching practice and plenty of hands-on practical information will be provided. This also implies that a decent website is indispensable since the TAs themselves need to work with web applications in their teaching practice. This will provide the TAs with the materials used in all of the new sessions, some readymade preparation and evaluation sheets and additional didactic background information.

Formal principles

In the existing TA training, the number of participants could reach up to 35 or even 40 TAs in one session. Since the TAs themselves, as well as some of the coaches, indicated that this is too much, the number of participants in all of the sessions will be significantly smaller, with a maximum of 20 participants per session. This will enable the coaches to invest more in the individual TAs and to pay attention to their individual questions and wishes. The results of the survey and hearings revealed that some TAs had a hard time keeping focus during the entire session or that they experienced some of the information as non-relevant to their specific teaching practice. In order to resolve this issue, the course of the sessions will be far more interactive to guarantee sustained attention from the

participants while keeping the element of peer learning through role-play, discussions and case studies. To heighten the credibility, (video-) testimonials of experienced TAs will be included.

Structural principles

Earlier, some of the TAs reported not being able to attend at least two of the sessions (which they are required to do in order to obtain their PhD) due to a lack of sessions, while others needed to start their teaching assignment without any experience or preparation. Therefore, the new TA training will take place in two dense weeks during the academic year, instead of dispersed sessions throughout the year. By centring the entire TA training around two weeks, we hope to achieve a higher visibility of the training, as well as the most ideal timing for starting TAs. Both blocks of sessions will provide starting and comeback sessions, thus enabling the TAs to easily rotate through the training program and to get a follow-up on their preparatory session at a comeback moment. Since Hattie and Timperley [12] demonstrated the importance of feedback in a learning context to reduce discrepancies between current achievements and the final goal and no follow-up opportunity existed yet, a second session will be provided in order to evaluate the TAs' teaching experiences. This feedback can enhance the learning process (and therefore the teaching practice) of the TAs by adopting self-assessment and evaluation strategies that can lead to a heightened self-efficacy to tackle challenging tasks.

Last but not least, many TAs reported that they do not feel sufficiently supported in their teaching assignment and that their PhD research often is considered to be more important by their promoter, who often doesn't seem to realise the positive influence of teaching experience on the methodological skills of their TAs [13]. On top of that, the workload isn't evenly distributed between all TAs and they often miss a concrete link between their research and their everyday teaching practice. Therefore, some attention needs to be paid to the relationship between the TAs and their didactical teams. In order to solve these issues, there is a need for better communication between the members of the didactic teams and a broader appreciation at a structural level of the educational tasks of the TAs.

3 BLUEPRINT FOR THE NEW EDUCATIONAL TRAINING PROGRAM

3.1 Visual Schema

In the schema below, a visual representation of the blueprint for the new TA training can be found. The content and format of the training sessions will be based on some general didactic objectives, as well as more specific objectives, formulated per session. The three major building blocks of the training are a first contact moment, a comeback session and the possibility of an assignment in between those two sessions. This assignment could be used as a means of providing the TAs with feedback on their current teaching practice.

On top of a number of training sessions hosted by educational staff at the Faculty of Engineering Science, a corresponding website will be developed. This way, the TAs will be provided with the materials of all sessions, regardless of which they chose to attend. The website will also offer them some background information and possibly the assignments the TAs may have to prepare in between sessions.

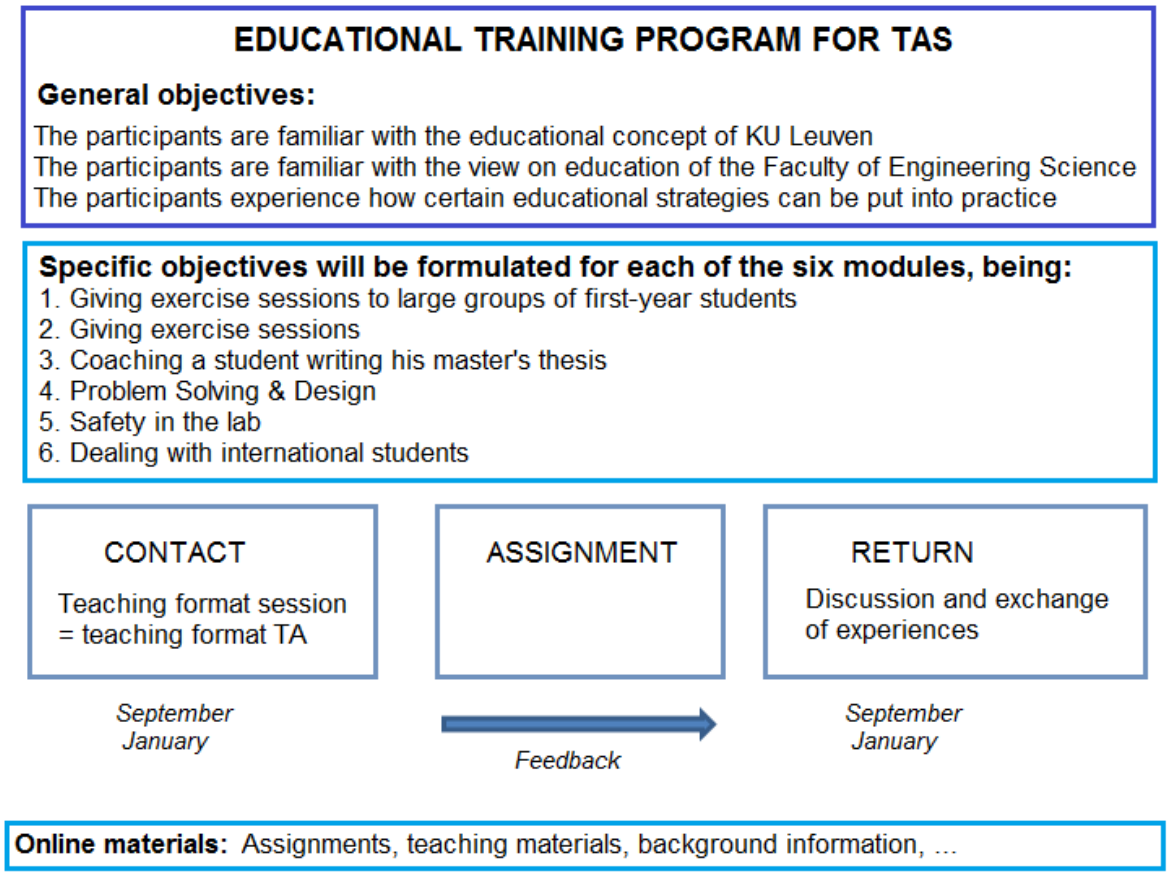

Fig. 1. Visual scheme of the blueprint for the new educational training program

3.2 Improvements of the new TA training program

Substantive

As indicated earlier, the new training program will be based on the 'teach as you preach' principle, which will lead to a more practice-focused content for the sessions. The current sessions will be thoroughly revised, in order to prevent an overload of information that doesn't apply to the teaching practice of the attending TAs. The focus will be on practical hands-on information, which can be applied easily by the TAs in their everyday practice.

Six different training sessions will be developed, being:

1. Giving exercise sessions to large groups of first-year students
2. Giving exercise sessions
3. Coaching a student writing his master's thesis
4. Problem Solving & Design
5. Safety in the lab
6. Dealing with international students

The content of each of these sessions will vary according to the theme of the module, yet most of them will consist of the same general building blocks. There will be attention for the preparation of the contact moment with the students, we will give them some basic insight in class management and the incorporation of modern technological devices (e.g. a voting system) and they will get acquainted with the basics of giving feedback and evaluating the students, as well as themselves.

The materials used in each of the coaching sessions will be made available at a newly developed website, dedicated entirely to the TA training program. The TAs can use this website to retrieve the

materials of all of the sessions, preventing them to having to attend each single one of them if only a small part of the session is to their use. Some readymade files will be provided there, such as class preparation and evaluation sheets, as well as additional background information on didactics for those who are interested.

Formal

Even though many TAs indicated in the survey that they quite appreciate the current classical 'class' format of the training sessions, this format will be slightly altered as a consequence of the 'teach as you preach' approach. For the first module (*Giving exercise sessions to large groups of first-year students*), for example, no fundamental changes will be necessary since the practice of an exercise session strongly resembles the class format of the currently existing sessions. This doesn't go for modules like *Problem Solving & Design* or *Safety in the lab*, since these are characterized by a totally different approach in practice. Hence, their formats will be adapted to more closely mirror the contact moments between the TA and the students.

On top of that, the maximum number of participants in a session will be significantly smaller, since only 20 will be allowed at once, instead of 35 to 40 TAs. This will facilitate a higher interactivity in the course of the sessions, which is something the respondents explicitly asked for in the survey and the hearings. As the peer learning-aspect was widely appreciated, this will be retained in the new TA training format and some video testimonials by experienced TAs will be included to ensure the diversity of the course of the sessions which will influence the attention of the participants, as well as to heighten credibility by lowering the psychological distance between the TAs and the coaches of the sessions.

Structural

The first structural change in the new TA training program will be the new timing of the sessions. They will no longer be provided throughout the entire academic year, but will be centred around two weeks, one in September before the start of the academic year and one in January at the start of the second semester. TAs will be able to attend a follow-up session in the second week (e.g. in January when they had their first in September), which they will possibly have to prepare with an assignment. This timing will enable newly starting TAs to follow the session(s) they need before their actual teaching assignment starts, thus not leaving them unprepared. On top of that, these dense session-weeks will heighten the visibility of the TA training program, which might beneficially influence the attitude towards the program.

This leads us to the second major structural change in the new TA training, being an improved communication between the TAs and their didactical team. In the questionnaire and hearings, many TAs reported that their teaching assignment is not always a priority for their promoter and that they feel more supported in their doctoral research. Some of the TAs report that they sometimes aren't well informed on the contents of the course or the goals that are set for the students, while others have to teach a course that isn't closely related to the subject of their PhD or that they even never attended themselves. As a consequence, there seems to be a need for better communication on the courses that fall under the responsibility of the TAs, which could be achieved by starting each semester with a meeting with all the members of the didactic team of that specific course. This will enable the TAs to get to know the goals for the students and the materials they're working with and to get in contact with the professor and fellow (more experienced) colleagues.

4 SCRIPTS, MATERIALS AND FUTURES

To ensure a standardized course for all of the different sessions of the new TA training program, scripts will be designed that describe the course of each of the sessions in detail. These will serve as a guidebook for the coaches of the sessions and will contain information on the duration of the session, the maximum number of participants allowed, the target audience and the format of the session. On top of that, it will list the goals for the participants of that particular session, the format of the session (possibly an assignment the TAs have to prepare, the course of the contact moment itself) and the materials needed by the coaches. At the end of each script, an exemplary scenario of the session will be provided.

The next step in the creation of the new TA training program is developing the necessary materials for the sessions and the website that goes with them. For the sessions, small text books (some 20 pages)

will be designed that will be distributed among the participants. These will contain the theory of that session, along with a list of practical tips and tricks, case studies, some readymade sheets (e.g. evaluation, preparation) and a number of exercises that will be addressed in the course of the session. For the coaches of the sessions, Power Point presentations will be provided.

On the website that will be developed simultaneously, TAs will be able to find the materials that are provided in each of the sessions such as the Power Point presentations, the materials included in the text books, additional exercises and some didactic background information.

After the blueprint of the new TA training has been designed, the scripts for each of the sessions have been written and all the necessary materials and a supplemental website have been developed, the educational training program for TAs can be implemented. We aim to do this at the start of the next academic year at KU Leuven, in September 2014.

5 CONCLUSION

The new TA training will be based on the needs that emerged from the questionnaire and hearings among TAs at four faculties and it will be developed according to the 'teach as you preach' principle. Therefore, it will be better adapted to the existing issues of these TAs, by departing from their everyday teaching practice. Now that the basic blueprint for this educational training program has been designed, the accompanying scripts and materials (online as well as offline) need to be developed. After the implementation of the new training in the next academic year, we will closely monitor further developments and evaluate the efficiency of these newly designed training sessions.

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